

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 General requirements that are common to NMS sections found in Division 26 – Electrical. This section supplements requirements of Division 1.

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-12, Canadian Electrical Code
  - .2 CSA C22.2
  - .3 CAN/CSA-C22.3 No. 1-01, Overhead Systems.
  - .4 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.3 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English and French.
- .4 Use one nameplate or label for each language.

**1.4 SUBMITTALS**

- .1 Shop drawings:
  - .1 Submit drawings for review, prior to ordering/purchasing any equipment.
- .2 Quality Control:
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
  - .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees: in accordance with General Conditions of contract.
  - .5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.3 Manufacturer's Field Reports: submit to Departmental Representative, manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

## **1.5 QUALITY ASSURANCE**

.1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction.

## **1.6 SYSTEM STARTUP**

.1 Instruct, Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

## **Part 2 Products**

### **2.1 MATERIALS AND EQUIPMENT**

.1 Material and equipment to be CSA certified. Where CSA certified equipment is not available, obtain special approval from authority having jurisdiction.

.2 Factory-assemble control panels and component assemblies.

### **2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Divisions 21, 22 and 23 and as shown on mechanical drawings.

### **2.3 WARNING SIGNS**

.1 As specified and to meet requirements of Electrical Inspection Department.

.2 Decal signs, minimum size 175 x 250 mm.

### **2.4 WIRING TERMINATIONS**

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

**2.5 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: lamicoïd 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self-tapping screws.
  - .2 Sizes as follows:
 

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters
- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

**2.6 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.10-07.
- .4 Use colour-coded wires in communication cables, matched throughout system.

**2.7 CONDUIT AND CABLE IDENTIFICATION**

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	

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	Prime	Auxiliary
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

**2.8 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

**3.2 NAMEPLATES AND LABELS**

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

**3.3 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

**3.4 LOCATION OF OUTLETS**

- .1 Locate outlets as shown on drawings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

**3.5 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

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### **3.6 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

### **3.7 FIELD QUALITY CONTROL**

- .1 Load Balance:
  - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .3 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct and pay for the following tests:
  - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control.
  - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .5 Systems: fire alarm system, communications.
  - .6 Insulation resistance testing:
    - .1 Electrical insulation and leakage test circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Electrical insulation and leakage test 350-600 V circuits, feeders and equipment with a 1000 V instrument.
    - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Report(s).
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.8 CLEANING**

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

**3.9 COORDINATION OF MECHANICAL AND ELECTRICAL WORK**

- .1 Provide complete wiring and connections for all motors and other electrical equipment specified in Division 22 and 23.
- .2 Determine characteristics of equipment specified in Division 22 and 23. Provide proper starters, relays, coils, auxiliary contacts and interlocks.

**END OF SECTION**

**Part 1        General**

**1.1            REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2No.18-13, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  - .2 CSA C22.2No.65-13, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

**Part 2        Products**

**2.1            MATERIALS**

- .1 Pressure type wire connectors with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors for armoured cable, flexible conduit as required.

**Part 3        Execution**

**3.1            INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
  - .2 Install fixture type connectors and tighten. Replace insulating cap.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL**

- .1        In general, the wiring is not shown on the drawings for the different systems: the necessary wiring shall however be provided between all outlets and the panels and/or relays to which they are referred to on drawings. In some cases, the panel identification is not given for each circuit but is shown for particular area.

**Part 2            Products**

**2.1                BUILDING WIRES**

- .1        Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2        Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

**2.2                UNDERGROUND WIRES (DUCT BANK)**

- .1        Conductors: stranded
- .2        Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

**2.3                TECK CABLE**

- .1        Cable: to CAN/CSA-C22.2 No. 131-14.
- .2        Conductors:
  - .1        Grounding conductor: copper.
  - .2        Circuit conductors: copper, size as indicated.
- .3        Connectors:
  - .1        Watertight, approved for TECK cable.

**Part 3            Execution**

**3.1                INSTALLATION OF BUILDING WIRES**

- .1        Install wiring as follows:
  - .1        All cables in suspended ceiling shall be properly strapped.
  - .2        Use armoured cables only in suspended ceilings when making final connection to equipment or in location(s) pre-approved by Departmental Representative.

**3.2                INSTALLATION OF TECK CABLE 0 TO 1000 V**

- .1        Install cables.

- .1 Group cables wherever possible on channels.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 TO 1000 V.

**END OF SECTION**

**Part 1        General**

**1.1            REFERENCES**

- .1        American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
  - .1        ANSI/IEEE 837-1996, Qualifying Permanent Connections Used in Substation Grounding.
- .2        Canadian Standards Association, (CSA International)

**Part 2        Products**

**2.1            EQUIPMENT**

- .1        Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2        System and circuit, equipment, grounding conductors, bare, stranded copper, soft annealed, size as required.
- .3        Insulated grounding conductors: To be to Section 26 05 21 – Wiring and Cables (0-1000V).
- .4        Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1        Grounding and bonding bushings.
  - .2        Protective type clamps.
  - .3        Bolted type conductor connectors.
  - .4        Thermite-welded type conductor connectors.
  - .5        Bonding jumpers, straps.
  - .6        Pressure wire connectors.

**Part 3        Execution**

**3.1            INSTALLATION GENERAL**

- .1        Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2        Install connectors in accordance with manufacturer's instructions.
- .3        Protect exposed grounding conductors from mechanical injury.
- .4        Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5        Soldered joints not permitted.
- .6        Install bonding wire for flexible conduit, connected at both end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7        Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

**3.2 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

**3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 – Electrical General Requirements.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**END OF SECTION**

**Part 1            General**

**1.1                SPLITTERS**

- .1      Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2      Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3      At least three spare terminals on each set of lugs in splitters less than 400 A.

**1.2                JUNCTION AND PULL BOXES**

- .1      Welded steel construction with screw-on flat covers for surface mounting.
- .2      Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

**Part 2            Execution**

**2.1                SPLITTER INSTALLATION**

- .1      Install splitters and mount plumb, true and square to the building lines.
- .2      Extend splitters full length of equipment arrangement except where indicated otherwise.

**2.2                JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1      Install pull boxes in inconspicuous but accessible locations.
- .2      Mount cabinets with top not higher than 2 m above finished floor.
- .3      Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

**2.3                IDENTIFICATION**

- .1      Provide equipment identification in accordance with Section 26 05 00 – Electrical General Requirements.
- .2      Install size 2 identification labels indicating voltage and phase.

**END OF SECTION**

**Part 1           General**

**1.1               REFERENCES**

- .1       CSA C22.1-15, Canadian Electrical Code, Part 1.

**Part 2           Products**

**2.1               OUTLET AND CONDUIT BOXES GENERAL**

- .1       Size boxes in accordance with CSA C22.2.
- .2       102 mm square or larger outlet boxes as required for special devices.
- .3       Gang boxes where wiring devices are grouped.
- .4       Blank cover plates for boxes without wiring devices.
- .5       Combination boxes with barriers where outlets for more than one system are grouped.

**2.2               SHEET STEEL OUTLET BOXES**

- .1       Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2       Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3       102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4       102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

**2.3               FITTINGS - GENERAL**

- .1       Bushing and connectors with nylon insulated throats.
- .2       Knock-out fillers to prevent entry of debris.
- .3       Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4       Double locknuts and insulated bushings on sheet metal boxes.

**Part 3           Execution**

**3.1               INSTALLATION**

- .1       Support boxes independently of connecting conduits.
- .2       Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3       For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

**END OF SECTION**

**Part 1            General**

**1.1                LOCATION OF CONDUITS**

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

**Part 2            Products**

**2.1                CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel, threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

**2.2                CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 5 m oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

**2.3                CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90 degree bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

**2.4                EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

**2.5                FISH CORD**

- .1 Polypropylene.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

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- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
  - .3 Use rigid galvanized steel threaded conduit except where conduit is subject to mechanical injury.
  - .4 Use electrical metallic tubing (EMT) for general use, except in cast concrete.
  - .5 Use rigid PVC conduit underground.
  - .6 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
  - .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
  - .8 Install conduit sealing fittings in hazardous areas. Fill with compound.
  - .9 Minimum conduit size for lighting and power circuits: 19 mm.
  - .10 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
  - .11 Mechanically bend steel conduit over 19 mm dia.
  - .12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
  - .13 Install fish cord in empty conduits.
  - .14 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
  - .15 Dry conduits out before installing wire.

### **3.2 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 26 05 00 – Common Work Results for Electrical.

**1.2                DEFINITIONS**

- .1            Priority Two (P2) Buildings: Buildings in which life safety is of paramount concern. It is not necessary that P2 buildings remain operative during or after an earthquake.
- .2            SRS: Acronym for Seismic Restraint System.

**1.3                GENERAL DESCRIPTION**

- .1            This section covers the design, supply, and installation of complete SRS for all systems and equipment specified for installation on this project. This includes (but not limited to) electrical light fixtures, conduit, communications/electrical equipment and systems, including those that are vibration-isolated or statically-supported.
- .2            SRS to be fully integrated into, and compatible with:
  - .1            Noise and vibration controls specified elsewhere in this project specification.
  - .2            Structural, mechanical, and electrical design of project.
- .3            During seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from a normal position.
- .4            Design to be by a Professional Engineer specializing in design of SRS and registered in the Province of Ontario. Division 26 to include all costs associated with this work as it relates to electrical installations. Submit design sketches complete with professional stamp prior to start of installations, complete with installation requirements.

**1.4                REFERENCES**

- .1            CSA G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.

**1.5                SUBMITTALS**

- .1            Submit shop drawings and product data in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2            Submittals to include:
  - .1            Full details of design criteria.
- .3            Submit additional copy of shop drawings and product data to Structural Engineer for review of connection points to building structure.

**Part 2            Products**

**2.1                SRS MANUFACTURER**

- .1            SRS to be from one manufacturer regularly engaged in production of the same.

## **2.2 GENERAL**

- .1 SRS to provide gentle and steady cushioning action and avoid high impact loads.
- .2 SRS to restrain seismic forces in all directions.
- .3 Fasteners and attachment points to resist same load as seismic restraints.
- .4 SRS of conduit systems to be compatible with:
  - .1 Expansion, anchoring, and guiding requirements.
  - .2 Equipment vibration isolation and equipment SRS.
- .5 SRS utilizing cast iron, threaded pipe, or other brittle materials are not permitted.
- .6 Attachments to RC structure:
  - .1 Use high-strength mechanical expansion anchors.
  - .2 Drilled or power-driven anchors not permitted.
- .7 Seismic control measures not to interfere with integrity of firestopping.

## **2.3 SRS FOR STATIC EQUIPMENT OR SYSTEMS**

- .1 Floor-mounted equipment or systems:
  - .1 Anchor equipment to equipment supports.
  - .2 Anchor equipment supports to structure.
  - .3 Use size of bolts scheduled in approved shop drawings.
- .2 Suspended equipment or systems:
  - .1 Use one or combination of the following methods:
    - .1 Install tight to structure.
    - .2 Cross-brace in all directions.
    - .3 Brace back to structure.
    - .4 Slack cable restraint system.
  - .2 SRS to prevent sway in horizontal plane, “rocking” in vertical plane, and sliding or buckling in the axial direction.
  - .3 Hanger rods to withstand compressive loading and buckling.

## **2.4 SRS FOR VIBRATION-ISOLATED EQUIPMENT OR SYSTEMS**

- .1 Floor-mounted equipment or systems:
  - .1 Use one or combination of following methods:
    - .1 Vibration isolators with built-in snubbers.
    - .2 Vibration isolators and separate snubbers.
    - .3 Built-up snubber system approved by Structural Engineer, consisting of structural elements and elastomeric layer.
  - .2 SRS to resist complete isolator unloading.
  - .3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.
  - .4 Cushioning action to be gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.

- .2 Suspended equipment and systems:
  - .1 Use one or a combination of the following methods:
    - .1 Slack cable restraint system.
    - .2 Brace back to structure via vibration isolators and snubbers.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Attach points and fasteners:
  - .1 To withstand same maximum load that seismic restraint is to resist and in all directions.
  - .2 Install SRS at least 25mm from all other equipment, systems, and services.
  - .3 Miscellaneous equipment not vibration-isolated:
    - .1 Bolt through house-keeping pad to structure.
  - .4 Co-ordinate connections with all disciplines.

**3.2 INSPECTION AND CERTIFICATION**

- .1 SRS to be inspected and certified by Manufacturer upon completion of installation.
- .2 Provide written report stamped by Professional Engineer licensed in the Province of Ontario to Engineer with signed certificate of compliance with the SRS design requirements.

**3.3 COMMISSIONING DOCUMENTATION**

- .1 Upon completion and acceptance of certification, hand over to Departmental Representative complete set of construction documents, revised to show “as-built” conditions.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Dry type transformers with ratings up to 5000 kVA single phase and up to 7500 kVA three phase and voltage class up to 46 kV.

**1.2                REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA C9-M1981(R2001), Dry-Type Transformers.
- .2        Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1        EEMAC GL1-3-1988, Transformer and Reactor Bushings.
- .3        National Electrical Manufacturers Association (NEMA)

**1.3                SOURCE QUALITY CONTROL**

- .1        Submit test certificate to Departmental Representative.

**1.4                SHOP DRAWINGS**

- .1        Submit shop drawings electronically in PDF format.
- .2        Include:
  - .1        Dimensioned drawing showing enclosure, mounting devices, terminals, taps, internal and external component layout.
  - .2        Technical data:
    - .1        kVA rating.
    - .2        Primary and secondary voltages.
    - .3        Frequency.
    - .4        Phase
    - .5        Polarity or angular displacement.
    - .6        Full load efficiency.
    - .7        Regulation at unity pf.
    - .8        BIL.
    - .9        Insulation type.
    - .10      Sound rating.

**1.5                DELIVERY, STORAGE AND HANDLING**

- .1        Store transformers indoors in dry location.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Dry-type transformers: to CSA C9.

## **2.2 TRANSFORMER CHARACTERISTICS**

- .1 Provide one (1) 15kVA transformer:
  - .1 Type: ANN
  - .2 Rating: 15 kVA, 3 phase, 60 Hz.
  - .3 220 insulation system class, 150 degrees C temperature rise.
  - .4 Impedance: 4.5-5.5 %
  - .5 BIL 10kV
  - .6 Primary winding: 600V, delta
  - .7 Secondary winding: 208V, wye
  - .8 Sound rating: 50dB max.

## **2.3 ENCLOSURE**

- .1 Fabricated from sheet steel.
- .2 Bolted removable panels for access to tap connections, enclosed terminals
- .3 Designed for floor.
- .4 Ventilated, self cooled type, enclosure c/w drip shield.

## **2.4 VOLTAGE TAPS**

- .1 Standard.

## **2.5 WINDINGS**

- .1 Primary and secondary coils:
  - .1 Copper.

## **2.6 WARRANTY**

- .1 Guarantee that all materials are first-class and proper for their intended use. Further guarantee is required on all materials and workmanship for a period of one (1) year from start-up or a maximum of eighteen (18) months after delivery. Make any repairs at no extra cost during this warranty period so that all equipment operates properly.

**END OF SECTION**

**Part 1        General****1.1            SECTION INCLUDES**

- .1        Materials and installation for standard and custom breaker type panelboards.

**1.2            REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA C22.2No.29-M1989(R2004), Panelboards and enclosed Panelboards.

**1.3            SHOP DRAWINGS**

- .1        Submit shop drawings in accordance with Section 26 05 00 – Electrical General Requirements.
- .2        Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**Part 2        Products****2.1            PANELBOARDS**

- .1        Panelboards: to CSA C22.2No.29 and product of one manufacturer.
  - .1        Install circuit breakers in panelboards before shipment.
  - .2        In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2        Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .3        Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .4        Two keys for each panelboard and key panelboards alike.
- .5        Copper bus with neutral of same ampere rating as mains.
- .6        Mains: suitable for bolt-on breakers.
- .7        Trim with concealed front bolts and hinges.
- .8        Trim and door finish: baked grey enamel
- .9        Complete with drip shield

**2.2            BREAKERS**

- .1        Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

**2.3            EQUIPMENT IDENTIFICATION**

- .1        Nameplate for each panelboard size 4 engraved.
- .2        Nameplate for each circuit in distribution panelboards size 2 engraved.

- 
- .3 Complete circuit directory with typewritten legend showing location and load of each circuit.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Connect loads to circuits.

**END OF SECTION**

**Part 1        General****1.1            REFERENCES**

- .1 Canadian Standards Association (CSA International).
  - .1 CSA-C22.2 No. 5-13, Moulded-Case Circuit Breakers, Molded-Case Switches.

**1.2            SUBMITTALS**

- .1 Submit product data in accordance with General Instructions.

**1.3            BREAKERS GENERAL**

- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
  - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Breaker interrupting capacity
  - .1 600V panelboards: 25kA symmetrical.
  - .2 250V panelboards: 10kA symmetrical.

**1.4            THERMAL MAGNETIC BREAKERS**

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

**Part 2        Execution****2.1            INSTALLATION**

- .1 Install circuit breakers as indicated.

**END OF SECTION**

**Part 1           General**

**1.1               SUBMITTALS**

- .1       Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

**Part 2           Products**

**2.1               DISCONNECT SWITCHES**

- .1       Fusible/non-fusible, disconnect switch in CSA Enclosure, size as indicated.
- .2       Provision for padlocking in on-off switch position by locks.
- .3       Mechanically interlocked door to prevent opening when handle in ON position.
- .4       Fuses: size as indicated.
- .5       Fuseholders: Relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6       Quick-make, quick-break action.
- .7       ON-OFF switch position indication on switch enclosure cover.
- .8       Complete with Drip Shields

**2.2               EQUIPMENT IDENTIFICATION**

- .1       Provide equipment identification in accordance with Section 26 05 00 – Electrical General Requirements.
- .2       Indicate name of load controlled on Size 4 nameplate.

**Part 3           Execution**

**3.1               INSTALLATION**

- .1       Install disconnect switches complete with fuses if applicable.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

**Part 2 Products**

**2.1 FIXTURE**

- .1 LED wet location strip light

**2.2 LAMPS**

- .1 LED lamps

Lamp Design	Bulb Wattage	Base	Type	Initial Lumens	Life h	Descrip.	Colour k
LED	24	N/A	RS	1800	60,000	cool white	4000

**2.3 BALLASTS**

- .1 LED driver.
  - .1 Rating: 120V, 60 Hz, for use with 32W, rapid start lamps.
  - .2 Totally encased and designed for 40 C ambient temperature and wet location.
  - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Locate and install luminaries as indicated.

**3.2 WIRING**

- .1 Connect luminaries to lighting circuit and control as indicated.

**3.3 LUMINAIRE SUPPORTS**

- .1 Wall mount/suspended.

**3.4 LUMINAIRE ALIGNMENT**

- .1 Align luminaries mounted in continuous rows to form straight line.
- .2 Align luminaries mounted individually parallel or perpendicular to building grid lines.

**END OF SECTION**

**Part 1           General**

**1.1           SECTION INCLUDES**

- .1   Materials and installation for emergency lighting systems.

**1.2           SHOP DRAWINGS AND PRODUCT DATA**

- .1   Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

**Part 2           Products**

**2.1           EQUIPMENT**

- .1   Emergency lighting equipment: to CSA C22.2 No.141.
- .2   Supply voltage: 120V, ac.
- .3   Output voltage: 12 V dc.
- .4   Operating time: 120 min.
- .5   Battery: sealed, maintenance free.
- .6   Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.
- .7   Solid state transfer circuit.
- .8   Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9   Signal lights: solid state, for 'AC Power ON'.
- .10   Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED equal to 9 W, minimum.
- .11   Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .12   Auxiliary equipment:
  - .1    Test switch.
  - .2    Cord and plug connection for AC.

**Part 3           Execution**

**3.1           INSTALLATION**

- .1   Install unit equipment and remote mounted fixtures.
- .2   Direct heads.

**END OF SECTION**